

WHAT IS CLAIMED IS:

1. A piston type pumping apparatus, comprising:

5 a vertically oriented cylinder having a top and a bottom, the bottom having a first aperture;

a first passageway for liquid in the cylinder at the top thereof;

10 a second passageway for liquid in the cylinder at the bottom thereof;

a piston reciprocatingly mounted within the cylinder and having an area against which pressurized fluid acts in the direction of movement of the piston;

15 a hollow piston rod connected to the piston and extending below the piston and slidably and sealingly through the first aperture in the bottom of the cylinder;

a reload chamber below the cylinder, the piston rod extending slidably and sealingly into the reload chamber and having a third passageway for liquid communicating with the reload chamber, the piston rod having a smaller area within the reload chamber upon which pressurized fluid in the reload chamber acts in a direction of movement of the piston and piston rod compared to said area of the piston;

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a first one-way valve located in the third passageway which permits liquid to flow from the reload chamber into and above the piston rod and prevents liquid from flowing back through the piston rod into the reload chamber;

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a fourth passageway for liquid extending from the reload chamber to a source of liquid to be pumped; and

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a second one-way valve in the fourth passageway which permits liquid to flow from the source of liquid into the reload chamber and prevents liquid from flowing from the reload chamber towards the source of liquid.

- 5        2.        The apparatus of claim 1, wherein the apparatus further includes means for storing pressurized liquid connected to the second passageway for storing pressurized liquid displaced below the piston, as the piston moves downwardly, and to assist in raising the piston and, accordingly, liquid contained within the piston rod, to pump liquid upwardly and through the first passageway.
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3.        The apparatus of claim 2 wherein the means for storing pressurized liquid includes a body of liquid.
4.        The apparatus of claim 3, including a pump connected to the body of liquid for
- 15        pumping liquid into the cylinder below the piston to raise the piston.
5.        The apparatus of claim 4, wherein the pump is a piston type pump.
6.        The apparatus as claimed in claim 5, wherein the pump is above the second
- 20        passageway.
7.        The apparatus of claim 4, wherein the pump is a centrifugal pump.
8.        The apparatus of claim 7, including a sixth passageway for liquid adjacent to the
- 25        bottom of the cylinder, a first conduit connecting the sixth passageway to the pump and a second conduit connecting the second passageway to the body of liquid.
9.        The apparatus of claim 8, wherein the body of liquid is a receiver.
- 30        10.        The apparatus of claim 9, including a pressure release valve adjacent to the second

passageway in the second conduit.

11. The apparatus of claim 1, wherein the apparatus further includes:

5 a second aperture in the top of the cylinder, the hollow piston rod extending above the piston and slidably and sealingly through the second aperture;

a transfer chamber above the cylinder, the piston rod above the piston extending slidably and sealingly into the transfer chamber;

10 a discharge chamber located above the transfer chamber;

a fifth passageway for liquid communicating from the transfer chamber to the discharge chamber; and

15 a third one-way valve in the fifth passageway which permits liquid to flow from the transfer chamber to the discharge chamber and prevents liquid from flowing from the discharge chamber towards the transfer chamber;

20 whereby pressurized fluid entering through the first passageway being operable to move the piston downwardly and pressurized fluid entering through the second passageway being operable to move the piston upwardly.

12. The apparatus of claim 11, wherein the piston is annular in shape.

- 25 13. The apparatus of claim 11, wherein the first one-way valve includes a first valve member, a first valve seat and a first valve passageway, the second one-way valve includes a second valve member, a second valve seat and a second valve passageway, and the third one-way valve includes a third valve member, a third valve seat and a third valve passageway.
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14. The apparatus of claim 11, wherein the hollow piston rod is cylindrical in shape.
- 5 15. The apparatus of claim 11, wherein the reload chamber is sealingly attached to the cylinder apart from the first aperture.
16. The apparatus of claim 11, wherein the transfer chamber is sealingly attached to the cylinder apart from the second aperture.
- 10 17. The apparatus of claim 11, wherein the discharge chamber is sealingly attached to the transfer chamber apart from the third one-way valve.
18. The apparatus of claim 11, wherein a diameter of the cylinder is greater than a diameter of the reload chamber.
- 15 19. The apparatus of claim 11, wherein a diameter of the cylinder is greater than a diameter of the transfer chamber.
- 20 20. The apparatus of claim 11, wherein a diameter of the hollow piston rod is equal to or less than a diameter of the transfer chamber.